Science literacies: a global perspective on primary science

Romaiza Naseem and **Nasima Hassan** outline the need for narratives in primary science to become more inclusive through the practice of decolonisation

A place for decolonisation narratives in science

Science has always been about broadening and increasing the depth of our understanding. It has always been about challenging existing narratives in light of new evidence or existing knowledge that may have previously been absent from the higher education curriculum. Teachers of science, those engaged in teacher training and school leaders occupy the driver's seat as decolonising curriculum-makers. Decolonising science education is embedded in a critical approach that aims to create counter-hegemonic intellectual spaces in which new worldviews can unfold in ways that can lead us toward changing practice.

This means that we are open to investing in our own subject knowledge to extend our science literacies in order to share a global perspective on primary science. We know this is important, as the decolonising movement has been global in scale, from the toppling of statues to the renaming of schools and a thoughtful scrutiny of the absence of global voices in our school curricula. The pervading Eurocentric focus has marginalised knowledge and contributed to cultural insensitivity that has limited the diversity of voices and experiences represented in education. The pervading stereotype (often reinforced in popular culture) of an aged man in a white lab coat as a representation of what a scientist looks like now seems to have little place in the global perspective of primary science, which aims to meet the needs of the diverse communities we serve and to inspire the science graduates of the future to pursue a career in teaching.

Towards a truer image of modern and historical science

This photo (Figure 1) captures great joy; our unconscious bias or prejudice might lead us to assume that the people are celebrating Diwali or some other cultural celebration. In reality, they are members of the Mars Orbiter Mission team of Indian scientists and engineers, celebrating the launch of a satellite that went into orbit successfully around Mars in 2014. The satellite was named *Mangalyaan* (from Sanskrit *Mangala* meaning Mars and *Yāna* meaning craft/vehicle).

A leading member of the team was Dr Moumita Dutta from Kolkata who was first inspired to follow her career path when studying light during her primary schooling. She found it fascinating and it led on to her study of engineering and physics. Indeed, Dr Dutta is now part of the science curriculum in India and is celebrated as an Indian physicist working at the Space Application Centre (SAC) and as a scientist/engineer for the Indian Space Research Organisation in Ahmedabad. She has expertise in the development and testing of the optical sensors/instruments/payloads (i.e. cameras and imaging spectrometers).

Over the centuries, colonisation of the curriculum has manifested in various ways, including the dominance of

Figure 1 What is being celebrated here?

Decolonisation ● **Cultural inclusivity** ● **Science**

Figure 2 Alhazen Hasan Ibn al-Haytham

Figure 3 Nasir al-Din al-Tusi (Iranian stamp issued in 1976)

Western scientific knowledge, more often than not to the exclusion of indigenous or non-Western perspectives and perpetuation of stereotypes and biases. The close relationship between science and the spread of European empires, as well as a disregard, erasure or misrepresentation of any non-Western scientific methods has arguably led to a widespread Eurocentric bias.

It is therefore important to recognise how European science has been largely built on the achievements of other cultures. Throughout the colonial era, science was strongly linked to the expansion of European empires. From the very beginning of this period, when European explorers were first venturing into the wider world, science was already practised elsewhere in the fields of navigation, astronomy and the development of new instruments. Indeed, colonial science would not have been as successful an endeavour if not for the indigenous populations.

The native populations were crucial in helping European explorers but they were rarely credited for their work. Colonial science was founded on a culture of exploitation. Although science at that time was seen as a European achievement, it would not have been possible without the help of the indigenous people. For example, Alhazen Hasan Ibn al-Haytham (Figure 2), a mathematician, astronomer and physicist from present-day Iraq, is now known as the 'father of modern optics'. Persian polymath, Nasir al-Din al-Tusi (Figure 3), supervised the building of the world's first observatory, which served many purposes beyond astronomy, including science and philosophy. His greatest mathematical achievement was founding the law of sines, which contributed to finding the lengths and angles of any triangle. His work was used (without accreditation) by Copernicus.

Finding a curricular fit

Two examples of how teachers might address cultural paucities in the current historical and contemporary narrative of science are Ibn al-Nafis, in the field of biology, and Professor Rana Dajani in the field of genetics.

Ibn al-Nafis

Ibn al-Nafis (Figure 4) was a pioneer in the field of cardiovascular physiology. His revolutionary account of pulmonary circulation – three centuries before any claims made by Europeans – highlights the vast array of international scientific contributions that are sometimes obscured by Western narratives. It can easily be incorporated into the key stage 2 National Curriculum for year 6 (ages 10–11) topic 'Animals including humans', providing pupils with an invaluable opportunity to establish a connection with their cultural heritage. Children gain a deeper comprehension of the diversity of scientific research and the riches of knowledge originating from various regions of the world as they study Ibn al-Nafis's scientific journey.

Through Ibn al-Nafis's story, children are inspired to proudly embrace their own cultural identities as well as the wonders of circulatory physiology. Commemorating his legacy encourages a new generation of scientists to confidently follow their ambitions, regardless of their background.

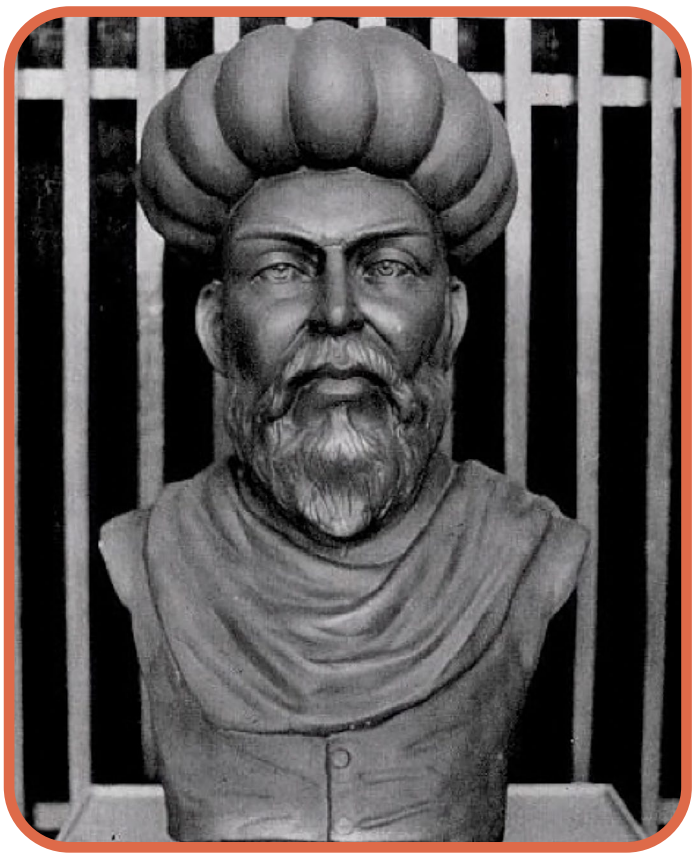

Figure 4 Ibn al-Nafis

Figure 5 Professor Rana Dajani

Professor Rana Dajani

Perhaps more representative of modern times, teachers may consider the narrative around Professor Rana Dajani (Figure 5), a well-known authority in genetics, stem-cell biology and molecular biology. She has devoted her professional life to expanding scientific understanding and advocating for educational change, especially in the Arab world, and currently holds the position of associate professor at the Hashemite University in Jordan. Dajani, who was born in Jordan, followed her love of science and graduated with a PhD in molecular biology from the University of Iowa in the USA. Professor Dajani has carried out innovative research throughout her career, concentrating on diverse facets of stem-cell biology and genetics. Her research has made a substantial contribution to our knowledge of the mechanisms underlying genetic diseases and the prospective uses of stem cells in medicine. She is an enthusiastic supporter of women in science and education reform in addition to her scientific pursuits. She has actively pushed to encourage women and girls to seek careers in science and has been outspoken about the significance of gender equality in STEM disciplines. Professor Dajani's support goes beyond gender parity to include more comprehensive Arab education reform. She has taken part in projects to enhance science instruction in schools, supporting curriculum creation and creative teaching strategies to encourage the next wave of scientists and thinkers.

Though not specifically addressed in the science curricula for key stages 1 and 2 in the UK, Professor Rana Dajani's contributions to science and education have had a profound global impact, motivating both educators and students to seek knowledge and effect positive change in their communities. The incorporation of her achievements and involvement in the scientific community undoubtedly has the potential to inspire students, encouraging them to aspire to become role models themselves.

Moving forward

Embracing a global perspective demands that the curriculum be repositioned to reflect how revolutionaries from around the globe have influenced the educational and scientific practices and ideas that we use today. Decolonising the science curriculum ultimately seeks to incorporate a broader range of perspectives, acknowledge the contributions of diverse cultures to scientific knowledge and promote a more inclusive and equitable approach to science education. By decolonising science education, we look to move from putting solely European scientists at the centre of our understanding of how science has developed over the ages towards a more genuine, authentic and truer knowledge of the subject. Ultimately, we should all seek to rewrite the erased chapters in our history books.

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